Differential Equations I
for Students of Engineering Sciences

Sheet 4, Exercise class

Exercise 1)

Determine which of the following differential equations is separable, linear, Bernoulli, Riccati or a similarity differential equation. If necessary provide a substitution which transforms the differential equation into a separable or linear differential equation. How do the new differential equations obtained by substitution read?

Hint: you don't have to solve the differential equations, but feel free to do so!

a) $(1 + e^{2t})u' = -2e^{2t}u$

b) $u' - 2t^2(u - 1) + tu(u - 2) = 1 - t - t^3$.   Hint: there is a solution $u_p(t) = \alpha t + \beta$.

c) $\cos(t)u' + \sin(t)u = -\cos^2(t)u$

d) $u - \frac{1}{t} - \frac{1}{u}u' = 0$

e) $u' = 2t(2t^2u^2 - 1)u$

f) $u - tu' = \dfrac{t^3}{u^2}$

Exercise 2)

Determine the general solution of the differential equation

$$u'(t) + 2u(t) - t\,u(t)^4 = 0.$$

Exercise 3: Compute the solution of the differential equation

$$u'(t) = 1 - t + t^2 + u(t) - 2tu(t) + (u(t))^2.$$

Hint: there exists a polynomial solution $u_p(t) = mt + k$.

Dates of classes: 27.11-01.12.2023.